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AN ANALYSIS OF A GROUP TEACHING PROCEDURE FOR PERSONS WITH DEVELOPMENTAL DISABILITIES

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This study evaluated whether a concurrent group teaching procedure, in which all students respond simultaneously, could be used for persons with moderate or severe mental retardation. The teaching procedure used was the Task Demonstration Model, a program based on stimulus-control research and the fading techniques of behavioral psychology. Three teachers and three groups of students participated. Results showed that the teachers increased their rates of questions and instructions, positive feedback, and use of functional materials, but they reduced their rate of prompts to almost zero. Students increased their percentage and rate of correct responding as well as their engaged time. In addition, maladaptive responding, for which there were never any direct consequences, decreased from 45% to 10% for 8 of the 14 students. Results are discussed primarily in two areas: (a) changing stimulus control from teacher prompts to critical elements of the items being taught, and (b) reasons for the reduction of maladaptive behavior for 8 of the subjects.

DESCRIPTORS: fading, group teaching, maladaptive behavior, mental retardation, Task Demonstration Model

Considerable effort has been directed toward studying the way skills are taught to individuals with developmental disabilities. The most common teaching approach involves prompting hierarchies, either most-to-least or least-to-most restrictive (Snell, 1987; Sternberg, 1988; Wolery, Bailey, & Sugai, 1988). Many researchers have reported success with these procedures (e.g., Brown, Bellamy, Perlmutter, Sackowitz, & Sontag, 1972; Csapo, 1981; Cuvo, Leaf, & Borakove, 1978). Others, however, have not found the prompting procedure to be effective (e.g., Koegel & Rincover, 1976; Schreibman, 1975; Schreibman, Charlop, & Koegel, 1982). The failure appears to occur because the learner attends to the prompt itself rather than to the relevant features of the stimulus (Schreibman, 1975). Stimulus control must transfer from the prompt to the stimulus, and at times it fails to do so.

An alternative to prompting hierarchies is a fading procedure in which the stimuli to be discriminated are manipulated along one or more dimensions (e.g., Sidman & Stoddard, 1966, 1967; Terrace, 1963a, 1963b). This procedure is attractive because it does not rely on a transfer of stimulus control from an extrastimulus prompt to the relevant feature of the correct stimulus. A program based on within-stimulus manipulations has been developed to teach persons with developmental disabilities a wide variety of tasks (Deitz, Rose, & Repp, 1986). Labeled the Task Demonstration Model or TDM, this procedure involves the following components for teaching discriminations: (a) the critical feature of the correct stimulus (S+) is identified, (b) multiple examples (e.g., 15) of the S+ are provided across trials, (c) multiple examples (e.g., 30) of incorrect stimuli (S−) are provided across trials, (d) the S+ and S− are simultaneously presented on each trial, (e) the S− differs from the S+ only on the critical feature during each trial, and (f) the S− systematically becomes more like the S+ over trials. The TDM is based upon general-case programming (Horner, Bellamy, & Colvin, 1984; Horner & McDonald, 1982), a procedure in which the irrelevant features of the S+ are varied across trials so that the student quickly learns to attend to the critical feature. In this way, the probability that stimulus control would have to be transferred from an irrelevant feature to the critical feature of the S+ is decreased.

The Task Demonstration Model as an instructional procedure is similar in many respects to the

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DISTAR materials in reading, mathematics, and language, and the small-group instructional procedures for those materials (Becker & Engelmann, 1978; Engelmann & Carnine, 1982). With the DISTAR materials, skills are taught with carefully selected examples and nonexamples such that a "general case" or generalized concept is mastered. The small-group instructional model maintains attention through teacher signals and unison responses. Correct responses are immediately reinforced, errors are minimized through pretraining procedures, and specific correction procedures are implemented following errors.

We have been using TDM to teach many tasks to persons with developmental disabilities, for the most part in group settings. Our research, however, has been limited to one-to-one teaching in which TDM could be compared with a standard prompting hierarchy. These studies (Karsh, Repp, & Lenz, 1990; Repp, Karsh, & Lenz, 1990) provided the necessary experimental control to compare these procedures, and they showed TDM to be superior to standard prompting in acquisition, generalization, and maintenance. They did not, however, address our goal, which was to develop a group teaching procedure in which fading procedures could be incorporated.

Alternatives to one-on-one instruction have been discussed by Reid and Favell (1984), who presented several models. One, the sequential model, involves teaching students individually while moving sequentially from 1 student to the next in a group. This is the most common procedure, but it is not really "group teaching." Instead, it is a one-to-one teaching paradigm for students who happen to be in a group. As such, it may not increase the rate of learning opportunities presented to students unless they learn by observation. A second model, the concurrent model, requires all students in a group to respond simultaneously. Such an approach has considerable appeal. It can produce a higher rate of learning opportunities, provide opportunities to learn social skills, and reduce maladaptive responding (Karsh & Repp, in press). Despite its potential advantages, this procedure is not commonly used for persons with severe handicaps. The purpose of this investigation was to test a group teaching procedure for persons with severe or moderate developmental disabilities. Because the TDM had already been shown to be superior to a prompting hierarchy (Karsh & Repp, in press; Karsh et al., 1990; Repp et al., 1990), these two procedures were not compared again. Instead, the TDM was presented to three groups of students within a multiple baseline design.

METHOD

Participants

Students and setting. Three groups of students in classrooms for persons with developmental disabilities participated. All met the AAMR definition of severe (Group 1) or moderate (Groups 2 and 3) mental retardation. Group 1 consisted of 5 students ranging in age from 17 to 21 years (M = 19 years, 9 months); all engaged in aberrant behaviors, including high rates of stereotypies. Group 2 consisted of 4 students ranging in age from 16 to 21 years (M = 18), and Group 3 consisted of 5 students ranging in age from 17 to 21 years (M = 19 years, 9 months). All students in Groups 2 and 3 engaged in various maladaptive behaviors, including stereotypy, self-injury, aggression, and general disruption. Most students used verbal communication, although some used gestures; all were ambulatory, and each had some independent living skills. All students were taught in their regular classrooms, and no students were added to or deleted from the groups for the purpose of this study.

Teachers. This study was conducted in a school in which the authors were implementing a model program for instructing students such as those previously described. Three teachers volunteered for this study, during which they taught their usual students. Each teacher had worked as a special education teacher for over 14 years and was certified in elementary education or special education. Because the teachers had no previous experience with TDM, the authors trained these teachers in workshops and in the classrooms to use TDM during the treatment phase. Sessions were usually conducted in the late morning or early afternoon during the times regularly scheduled for these activities.

Teaching Procedure

General procedures. The TDM is a teaching procedure that incorporates fading (Sidman & Stoddard, 1966, 1967; Terrace, 1963a, 1963b), general-case programming (Horner et al., 1984), and two skill hierarchies to teach discriminations of functional objects (e.g., words, foodstuffs, money values). In one hierarchy, a student learns to match an object to a sample, to identify the object, and then to name it. The objectives are to teach students to be more independent and to learn to communicate through speech rather than through devices like communication boards. In many cases, identification is used to prepare students to learn functional skills (e.g., finding soup or vegetable cans before cooking, locating a sweater to put on, or identifying quarters to put in a vending machine). In a second skill hierarchy, students are taught to follow instructions and are moved from one-to-one instruction to small-group instruction to large-group instruction as appropriate.

Fading and general-case programming are addressed in the following manner. First, the teacher identifies the critical and noncritical dimensions of the stimulus to be taught. For example, if the S+ was the number 5, the critical dimension would be form; noncritical dimensions would be size, color, script, texture, and background of the number. Then, the teacher selects multiple examples (approximately 15) of the S+ that adequately sample the noncritical dimensions. For example, the number 5 would appear in several colors, sizes, and scripts on various backgrounds and in various contexts (e.g., a menu, newspaper, book). Finally, the teacher selects multiple examples of the S− grouped into three categories describing the degree to which they differ from the S+; these categories are *very different, moderately different,* and *slightly different.*

Students are pretested and when necessary are taught using the skill hierarchy of matching to sample, then identification, then naming. In the matching-to-sample paradigm, a sample is placed before the student, and an S+ and one or more S−s are placed before the teacher. The student is then asked to touch the one like the sample. During identification, an S+ and one or more S−s are placed in front of the teacher. The student is then asked to touch the S+ (e.g., "touch the 5"). During naming, the teacher places an S+ in front of the student who is asked to name it; the same is done with the series of S−s. Here, the teacher may use a time delay procedure in which the teacher asks the question ("what is this?"), prompts with the answer ("5"), and then increasingly delays the prompt until it becomes feedback ("yes, this is a 5"). Following errors, the instruction is repeated (e.g., "touch the 5") with the materials (a) removed and returned to the same position and then (b) removed and placed in a different position on the table.

Instruction-following procedures. Because students respond in group instruction simultaneously, they must respond quickly and consistently to a cue (e.g., "touch the ___," "what is this?"). If the student does not demonstrate this skill, it is taught in a program that includes (a) a set of approximately 15 instructions, including all those the teacher uses while teaching in small groups, and (b) a prompting hierarchy in which noncompliance is followed first with a repeated instruction, then a touch if necessary, then physical guidance. Students in the program are sometimes then shaped and faded into group instruction by first learning in a one-to-one setting, then perhaps with only one other student, then with several others. In many cases, this program is completed in a brief session; in other cases, it may take longer.

Group teaching procedures. During group instruction, students generally sit at a table facing the teacher, who places a *different* set of S+ and S− materials in front of *each* student. An instruction (e.g., "touch the 5") is followed by a signal that the response should occur (e.g., the teacher claps her hands). The teacher then provides feedback for correct responding and the error correction procedure for incorrect responding. The students are then instructed to pass the set of materials to their left. In this way, each student receives a different set of materials on each trial.

Stimulus materials. The discriminations taught to the three groups of students during baseline and intervention are part of a functional community-referenced activity, such as preparing foods, purchasing items, or cleaning households. Group 1 was taught to match-to-sample and identify cooking utensils (e.g., a bowl, spoon, fork, and saucepan) and food items (e.g., canned soup and cereal). Later, they were taught to use the items. During baseline and intervention, materials were gathered from kitchen cupboards and drawers and used as the teaching stimuli. For example, during identification of "bowl," 15 bowls of various sizes, colors, and compositions were collected. Many S− items were used; three examples are a spatula (very different), a plate (moderately different), and a cup (slightly different). Group 2 was taught to match-to-sample and identify coins (quarter, dime, nickel, and penny) and coin combinations. This task was a prerequisite to using coins to pay for items. Both new and well-worn coins were used to teach the discriminations. When "quarter" was taught, a penny was a very different S−, a dime was a moderately different S−, and a nickel was a slightly different S−. Group 3 was taught to match-to-sample and identify cleaning products for washing windows, dusting furniture, cleaning sinks, and so forth. One example was Windex®, and spray bottles of various sizes with various amounts of Windex® were used as the S+. The S− examples were chosen from the range of common household cleaning products. Very different examples were cleaning items packaged in cartons or boxes, moderately different examples were items packaged in aerosol cans or bottles without spray pumps, and slightly different examples were items packaged in similarly shaped bottles with spray pumps. After students could find these items, they were taught to use them.

Experimental Procedures

Baseline. Prior to baseline, the teachers administered two-item discrimination probes to each student in order to select the stimuli to be taught during baseline and intervention. For an S+ to be selected for the teaching sequence, none of the students in a group could score above 60% correct on a baseline probe of 10 trials. During baseline, students in their naturally constituted groups were instructed according to the method each teacher normally followed. Baseline lasted 9, 12, and 16 days for the three groups.

Treatment. A multiple baseline design was used across the three groups of students and teachers. Training in the TDM was provided in two ways. First, the teachers participated in three workshops provided by the experimenters (see Karsh et al., 1990; Karsh & Repp, in press; Repp et al., 1990, for a summary). Following the workshops, one of the authors continued the training in each teacher's classroom.

The first 18, 16, and 9 days of treatment for Groups 1, 2, and 3 included feedback on the use of materials, pacing, and so forth. Later, maintenance probes were conducted for four, two, and six sessions for the three groups. These probes occurred under the conditions present during treatment.

Dependent Variables

Data were collected on student behaviors, teacher behaviors, and materials used. Although data were collected on 11 teacher categories, eight did not occur frequently enough to present in the results. The definitions for three teacher behaviors, eight student behaviors, and instructional materials appear in Table 1.

Data Collection

Data were collected on the teacher and each student in the group according to a sequential recording system discussed by Thomson, Holmberg, and Baer (1974). The observers were directed to observe (a) the teacher for 2 min, (b) Student 1 for 2 min, (c) Student 2 for 2 min, (d) the teacher for 2 min, (e) Student 3 for 2 min, (f) Student 4 for 2 min, (g) the teacher for 2 min, and so forth. The average teaching session was 22 min, and the first student to be observed each day was randomly determined.

The data were collected on a microcomputer

Table 1
Definitions of Variables

Teacher behaviors

(a) Question/instruction. During instruction, the teacher asks a question or delivers instruction that requires an immediate task-related response from the student. Question/instruction ends when the observer says "1,001" without teacher talk occurring or when the teacher exhibits a clearly different behavior. Therefore, a question/instruction can be a question followed immediately by related statements or questions. A repeated question that does not provide additional cues or prompts remains a question/instruction (a second count is not entered).

(b) Prompt. During instruction, the teacher uses verbal cues, visual cues, modeling, physical prompts, or physical guidance to assist the student in making an immediate task-related response. Verbal prompts end either when the observer is able to say "1,001" without the teacher talking, or when the teacher initiates a new behavior. Typically, prompts occur following question/instruction. A prompt provides information in addition to that in the original question/instruction.

(c) Positive feedback. During instruction, the teacher praises, smiles, delivers pats on the back, confirms statements, or repeats student's response to indicate that student's response was correct.

(d) Other. The teacher is not interacting with students, looking at students, or engaged in any active behaviors related to instruction. Recorded when none of the above behaviors apply.

Student behaviors

(a) Unprompted correct. A correct response that does not follow a teacher prompt.

(b) Prompted response. A response preceded by a teacher prompt.

(c) Incorrect response. An incorrect response to a question/instruction.

(d) Active engagement. Answering a question, asking a question, talking about the task, manipulating materials (functional objects, computer, games, picture cards, etc.), reading aloud, reading silently, writing.

(e) Passive engagement. When *active* responses are not occurring, student is looking at teacher, aide, peer, or materials.

(f) Other appropriate. Other appropriate behavior such as moving to new location in class (e.g., moving from group work table to desk), looking for materials, putting materials away, talking quietly to peer while waiting for lunch dismissal.

(g) Nonengagement. Student is not *actively* responding and is not looking at teacher, aide, peer, or materials.

(h) Stereotypy. Rhythmic repetitive motor movement without any apparent adaptive function in the context in which it occurs.

(i) Self-injury. Repetitive motor movement in which student attempts to inflict injury upon self.

Table 1
(*Continued*)

(j) Other inappropriate. Aggression to others (hitting, kicking, swearing), disruption (slamming desks and chairs), noncompliance (refusing to do task), inappropriate talk (talking to peer during instruction), inappropriate locale (wandering around room when student should be at desk).

Instructional materials

(a) Functional objects. Objects encountered in the community and used by nondisabled peers when engaged in similar tasks or activities (e.g., dishes, coins, dollar bills, Uno® game). Objects should also be age appropriate.

(b) Nonfunctional objects. Objects that are not used by nondisabled peers in the completion of functional tasks or activities (e.g., pegboards, Fisher-Price® toys). Generally not age appropriate.

(c) Written materials. Books, magazines, newspapers, worksheets, flashcards that contain written symbols (e.g., numbers, letters). This includes materials that combine pictures and words.

(d) No materials. No instructional materials are present.

through a system we have designed and explained in detail elsewhere (Repp, Harman, Felce, Van Acker, & Karsh, 1989; Repp, Karsh, Van Acker, Felce & Harman, 1989). In this system, codes are ascribed to keys onto which press-on labels are placed. Before the session began, the observer entered identifying information including the date, location, session, and names of the teacher, students, and data collector. Then, she began the session by pressing the TAB key, which activated the computer's timer. At the end of each 2 min, the computer sounded four notes that suspended the timer until the observer entered the code describing who was just observed (e.g., a 1 for Johnny, who was Student 1 that day in the sequence). The observer then recorded the behavior of another student or the teacher for 2 min, and so forth. At the end of the session, the computer automatically separated and printed the following summary data for each student and the teacher: (a) the number of occurrences for each code, (b) the rate for each code, (c) the total duration for each code, and (d) the percentage of the session each code occurred. Data were collected as frequently as possible, but not every day.

Interobserver Agreement

Two observers were trained to use the computer-based observation system, and baseline recording did not begin until the two observers had reliability scores greater than 80% on each code. Thereafter, reliability was assessed during 33% of the sessions in each phase.

Reliability was calculated in two ways, each based on the fact that the computers kept track of the second each code began and ended. Codes of very short duration (e.g., correct or incorrect responses) were entered by observers before the session as event codes. For these, the computer assigned a 1-s duration and defined an agreement as an occurrence recorded by the two observers within 2 s of each other. Codes of varying duration (e.g., stereotypy) were entered before the session as duration codes. For these, the computer compared the two observers' second-by-second record of each code and defined an agreement as each second in which both observers indicated a particular code was occurring (e.g., 1 s of agreement for stereotypy was counted if both observers had recorded it during Second 300; if only one observer recorded it during Second 301, it was counted as 1 s of disagreement).

The computer automatically calculated reliability when the observer chose that program, so no errors in calculation could have occurred. The percentage of agreement for each student code was (a) student unprompted correct: M = 95%, range, 83% to 100%; (b) student active engagement: M = 90%, range, 81% to 100%; (c) passive engagement: M = 85%, range, 81% to 96%; (d) other appropriate: M = 95%, range, 83% to 100%; (e) nonengagement: M = 92%, range, 77% to 100%; (f) stereotypy: M = 89%, range, 74% to 100%; (g) self-injury: M = 97%, range, 83% to 100%; and (h) other inappropriate: M = 90%, range, 79% to 98%.

Reliability estimates on the independent variable, the TDM package, were assessed in two ways. First, another observer wrote a description of the stimulus materials used, indicating whether the teacher was using matching to sample or identification, and whether the teacher was correctly moving from very different to moderately different to slightly different S−s during TDM. This information was also recorded by a project staff member. A comparison of these records showed a reliability score of 100% on these variables. The second method estimated the degree to which teacher behaviors changed from baseline to treatment as the teachers were trained to use TDM. Interobserver agreement percentages for these variables were (a) teacher question or instruction: M = 88%, range, 82% to 96%; (b) teacher prompt: M = 97%, range, 95% to 100%; (c) teacher positive feedback: M = 94%, range, 76% to 100%; (d) other: M = 87%, range, 75% to 100%; (e) functional objects: M = 99%, range, 94% to 100%; (f) nonfunctional objects: M = 99%, range, 88% to 100%; (g) no materials: M = 98%, range, 88% to 100%.

RESULTS

Although data were collected on all individual students, grouped data are presented in order to reduce the number of graphs (N = 84). (The individual-subject graphs are, however, available from the authors.) For each graph, days without data points indicate that instruction occurred but data collection did not. Figure 1 (left panel) shows the rate of unprompted correct responses for baseline, training, and maintenance, the means of which were 0.40, 1.03, and 2.15 responses per minute for Group 1; 0.74, 2.28, and 3.4 responses per minute for Group 2; and 0.09, 1.54, and 1.73 responses for Group 3. Overall, the rate increased from baseline to treatment and from baseline to maintenance by a factor of 4.0 and 5.9, respectively, for the 14 students. The data for Group 1 increased on the last day of baseline; a more robust effect may have been shown had another session of baseline been conducted.

Data on percentage of correct responses show a similar increase from baseline (Figure 1). Means for baseline, treatment, and maintenance were 33%, 71%, and 73% for Group 1; 51%, 79%, and 84% for Group 2; and 13%, 91%, and 90% for Group 3. Overall, the percentage correct increased for the 14 students by factors of 2.5 from baseline to treatment and 2.6 from baseline to maintenance.

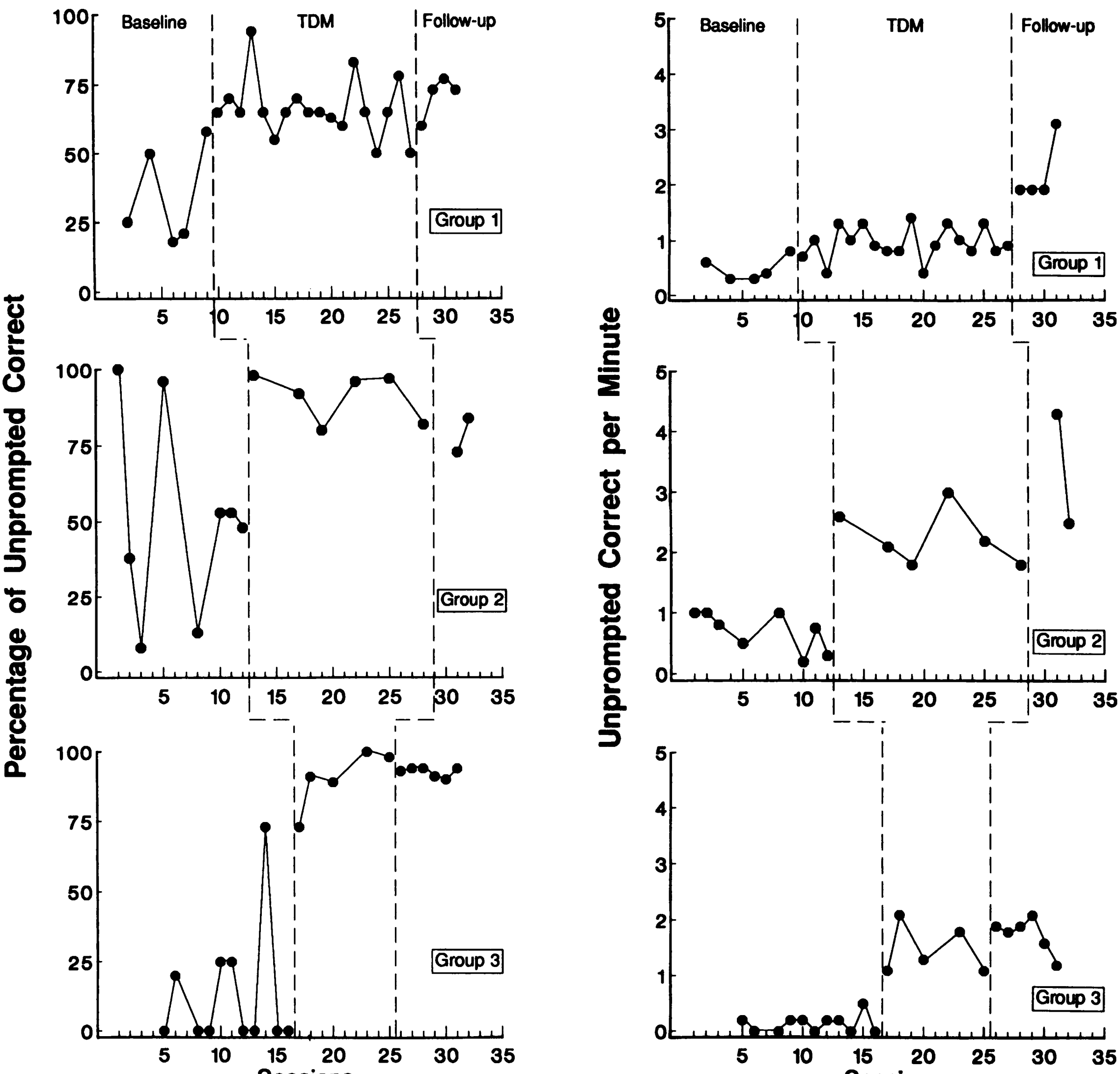

Figure 1. Number of unprompted correct answers per minute by three groups of students (right panel) and percentage of answers correct (left panel).

In addition, TDM reduced the variability of responding for two of the three groups. Responding for Group 1 varied from 14% to 58% during baseline and 50% to 95% during TDM. For Group 2, responding varied from 10% to 100% during baseline and 80% to 100% during TDM. For Group 3, responding varied from 0% to 70% during baseline and 70% to 100% during TDM.

Active engagement changed little from baseline to treatment for Group 1 (from 25% to 32%), not at all for Group 2 (from 40% to 40%), but considerably for Group 3 (from 8% to 33%). Passive engagement also showed differential change. For example, it changed from 32% to 47% for Group 1, from 11% to 50% for Group 2, and from 49% to 61% for Group 3. These data are combined and reflected in Figure 2, which shows that nonengagement [1 − (active + passive engagement)] changed from 43% to 21% for Group 1, from 49% to 10% for Group 2, and from 43% to 6% for Group 3.

The data on maladaptive behavior (stereotypy,

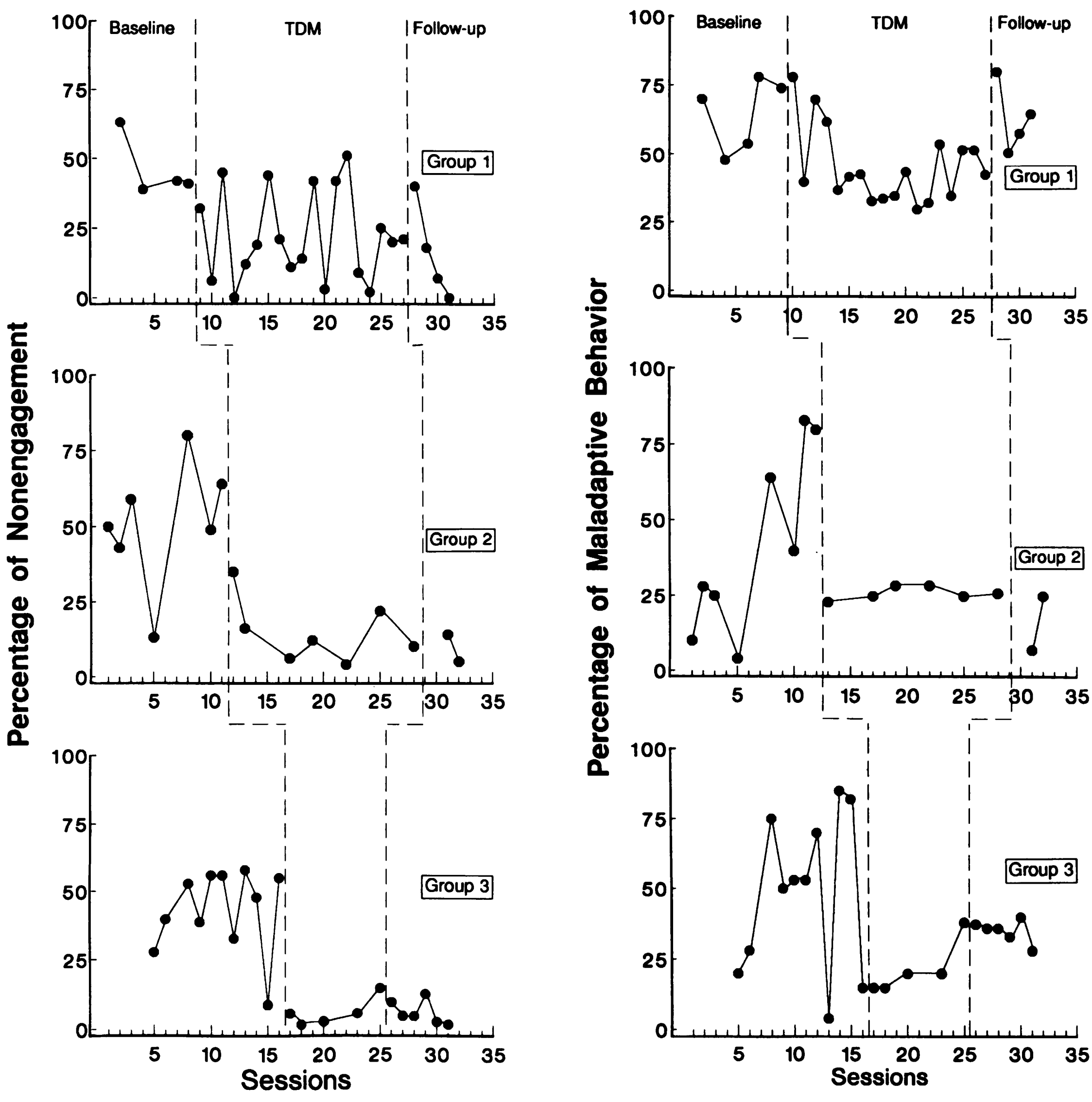

Figure 2. Percentage of teaching session in which students were not engaged either actively or passively, and percentage of teaching session in which students were engaged in stereotypy, self-injury, or aggression.

self-injury, and other inappropriate behavior) are also depicted in Figure 2. Although there were no direct consequences for it, maladaptive behavior for the three groups showed the following means for baseline and TDM: 65% and 46% for Group 1, 41% and 27% for Group 2, and 55% and 21% for Group 3. The relative changes (i.e., baseline/TDM) for Groups 1, 2, and 3 were 1.41 (65/46), 1.52 (41/27), and 2.62 (55/21). Data for the individual members of Group 1 showed that much of the maladaptive behavior was contributed by 1 subject. During baseline, TDM, and maintenance, this student engaged in stereotypy 93%, 83%, and 89% of the time. The other 4 students showed means of 54%, 35%, and 38% during these conditions.

To assess treatment integrity, we measured four behaviors: questions/instructions, prompts, positive feedback, and use of functional materials. The rates of questions/instructions showed a greater change from baseline to TDM for Teachers 1 and 2 than for Teacher 3 (whose rate was much higher than the others). The mean rates for Teachers 1, 2, and 3 were 1.60 and 4.05 responses per minute, 2.12 and 4.67 responses per minute, and 3.09 and 3.88 responses per minute, respectively, and represent a relative change (treatment/baseline) of 2.53, 2.20, and 1.25.

Figure 3 shows the rate at which teachers delivered prompts and positive feedback. Baseline rates of prompts for the 3 teachers were 1.2, 0.63, and 1.3 per minute, whereas the TDM rates were zero for each. This result is consistent with one of the objectives of TDM, which is to reduce extrastimulus prompts from teachers; thus it validates that portion of the TDM training objective. The change in rate at which positive feedback was given by the 3 teachers was greatest for Teachers 1 and 2, who had low rates in baseline. The mean rates for baseline and TDM were 1.4 and 4.6, 1.3 and 4.2, and 2.2 and 3.8 responses per minute, respectively. A comparison under the two conditions shows a relative change (treatment/baseline) of 3.28, 3.23, and 1.73 for the 3 teachers.

Another objective of TDM training was to change the teachers' use of functional objects. Data were collected on the percentage of the teaching sessions in which there were functional materials, written materials, or no materials present. Functional materials were used during baseline and training by the 3 teachers 46% and 100%, 49% and 100%, and 8% and 98% of the time, respectively. The relative changes (treatment/baseline) for the 3 teachers were 2.17, 2.04, and 12.25, respectively. Written materials also showed a change, but in the opposite direction (8% to 0%, 18% to 0%, and 84% to 0%, respectively). The absence of materials also changed in the same direction (46% to 0%, 33% to 0%, and 8% to 0%, respectively).

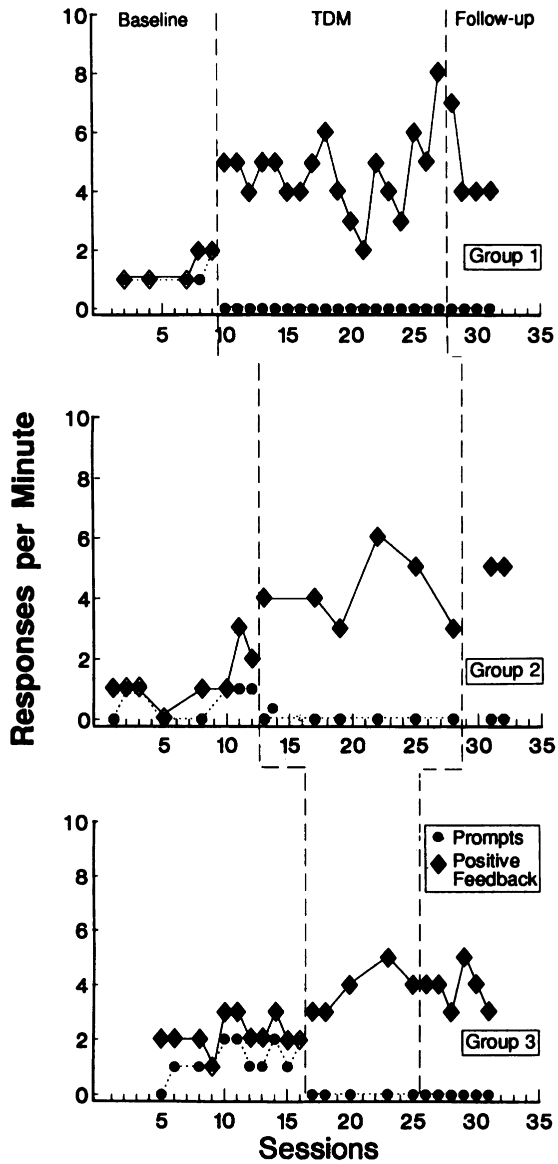

Figure 3. Prompts and positive feedback provided per minute by 3 teachers to their students.

DISCUSSION

Group teaching provides an attractive alternative for those working with persons with severe handicaps (Reid & Favell, 1984). Few teachers, however, use the concurrent group model in which all students respond simultaneously; instead the focus is generally on only 1 or 2 students at a time. The reasoning is that these students have such cognitive difficulties and high rates of maladaptive responding that the group objective is too ambitious. This study and one other (Karsh & Repp, in press) showed, however, that a program based on stimulus control can succeed with groups of these students.

One objective of a teaching program should be to increase both the rate and the percentage of correct responding. The present results showed significant mean changes in both measures. Rate correct, and thus opportunities to learn, increased from baseline by factors of 4.0 during intervention and 5.9 during maintenance. The percentage of correct responding increased by factors of 2.5 and 2.6 during these conditions.

In a prior study (Karsh & Repp, in press), we argued that percentage engagement may be a less sensitive measure of change than rate. In that study, engagement was relatively high in both baseline (74%) and treatment (80%); thus a ceiling effect may have been operating. The present study extends these results by showing that this model is not restricted to students already engaged a high proportion of the time. During baseline, students were engaged only 55% of the time, a figure that increased to 88% during intervention. Nevertheless, this measure again was less sensitive than rate. Percentage correct increased by a factor of 1.6, but rate correct increased by a factor of 4.0 during the second phase. Rate, of course, is the datum suggested many times by Skinner (e.g., Ferster & Skinner, 1957) as the most sensitive measure of behavioral change, and our data supported that choice for these behaviors.

Data on teacher behavior showed changes in all four categories. The reduction in prompts, from a mean of 1.03 in baseline to zero during TDM, is important for two reasons. First, when combined with the rate-correct data, it suggests that stimulus control has been shifted from teacher prompts to the stimuli being discriminated. This shift partially validates the TDM program, which attempts to establish this type of stimulus control through intrastimulus rather than extrastimulus prompts such as pointing, saying the answer, and so forth. Second, the result contradicts the general procedure for teaching these individuals. Curriculum books (e.g., Sternberg, 1988) suggest prompting hierarchies, research studies often use these procedures, and three of our own studies show that teachers used prompts at a high rate during baseline. The irony is that although we think we are helping students by using prompts, we may in the long run be hampering their acquisition of skills. Instead of making them dependent on the actual stimuli they are supposed to discriminate (e.g., coins, grocery items), we make them dependent on our prompts. This dependency has been addressed by Steege, Wacker, and McMahon (1987), who showed that a least-to-most restrictive prompting hierarchy, which always began with the least restrictive prompt, was less efficient than one in which the first prompt was at the level previously found effective. There may be other problems as well. First, prompts are often consequences and are more like guided compliance than instruction. Second, the least-to-most prompting hierarchy may *reinforce* maladaptive behavior as a chain of (a) verbal prompt, (b) maladaptive behavior, and (c) physical guidance (positive attention).

Teacher questions/instructions also changed: Two teachers more than doubled their rate, and a 3rd increased by 25%. Students of the latter teacher increased correct answers 17-fold (from 0.09 to 1.54 per minute), yet the teacher's baseline rate of questions/instructions was the highest (3.09 to 1.60 and 2.12 per minute), and the treatment rate was the lowest (3.88 to 4.05 and 4.67 per minute). Although important, rate of presentation is obviously not the only important factor.

Positive feedback also increased for all teachers. Again, however, the TDM rates were greater for the first 2 teachers (3.28 and 3.23) than for the 3rd (1.73). Change in rate then seemingly does not account for the total increase in rate correct by the students. More likely, a combination of stimulus control, reduced rate of prompts, and increased rate of questions and feedback accounted for these improvements. A component analysis could differentiate the effects of these factors. Change also occurred in the use of functional objects. Two teachers doubled their use, and the 3rd increased his use 12-fold. One can question whether students found these materials more interesting and whether their use contributed to higher rates of correct responding. That, of course, is an experimental question readily answered in follow-up research.

The final area of interest is maladaptive behavior. In our study, we identified three groups of students.

Two students increased maladaptive behavior from baseline to TDM (from 18% to 33%, and from 23% to 39%). Four others showed little change, whereas 8 showed substantial positive change. Their percentages of time in baseline and TDM were 51% and 3%, 27% and 0%, 65% and 18%, 48% and 15%, 67% and 17%, 12% and 0%, 77% and 24%, and 58% and 6%. Carr (1977) and others (e.g., Carr, Robinson, & Palumbo, 1990; Iwata, Vollmer, & Zarcone, 1990; Wacker et al., 1990) have suggested three reasons for maladaptive behavior: negative reinforcement, positive reinforcement, and stimulation. The first 2 students described above may have been in a negative reinforcement paradigm, whereas the last 8 may have been in either a positive reinforcement or a stimulation paradigm.

The behavior of the latter group has several implications for research and programming. If these behaviors were reinforced by attention, a program like this might change teacher behaviors sufficiently to produce a differential reinforcement paradigm that will extinguish maladaptive behavior and reinforce adaptive behavior. This effect could be studied within the matching law (Herrnstein, 1961), which predicts that behavior will be distributed according to relative rather than absolute rates of reinforcement. If the subjects were, on the other hand, responding to increased stimulation, they *may* be part of a group we characterize as homeostatic responders. These persons substitute one motor response for another, but from hour to hour engage in a relatively constant amount of responding. One recent study has shown that some persons may substitute an adaptive behavior for a maladaptive one, or vice versa (Repp, Karsh, Deitz, & Singh, in press). This phenomenon may have been displayed by the 8 subjects in our study. The challenge is to determine beforehand which students will benefit from these procedures without additional behavior-management programs. We have written of such procedures elsewhere (Repp & Karsh, 1990), as have others (e.g., O'Neill, Horner, Albin, Storey, & Sprague, 1990). In addition, we have noted (O'Brien & Repp, 1990, in press) that little is known about how to predict who will benefit from differential positive reinforcement. The interesting question in the present study, of course, is why TDM decreased inappropriate responding for these 8 but not for the other 6 students.

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